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Japanese Published Unexamined (Kokai) Patent Publication No. 60-028459; Publication Date: February 13, 1985; Application No. 58-135107; Application Date: July 26, 1983; Int. Cl.[4]: C09D 3/80 // C08F 212/12 220/12; Inventor(s): Keiji Sakata et al.; Applicant: Mitsui Toatsu Chemicals Inc.; Japanese Title: Akuriru Rakkaa (Acrylic Lacquer)

Specification

1. Title of Invention

Acrylic Lacquer

2. Claim

Acrylic lacquer, characterized by containing a copolymer at a 5000 to 50000 number average molecular weight, obtained by copolymerizing paramethyl styrene A at 5 to 95 weight % with other copolymerizable monomers B at 5 to 95 weight %, and if necessary containing one or two or more types of pigments, paint additives and fiber compounds, by a combination.

3. Detailed Description of the Invention

This invention pertains to acrylic lacquer. More specifically, the invention relates to lacquer with high water resistance, high weatherability and high chemical agent resistance, which is composed of a specific copolymer obtained using a specific amount of paramethyl styrene. The purposes of lacquer paint containing a cellulose compound have been expanded in various areas because of the user-friendliness in addition to the performance including drying performance.

Among acrylic lacquer, acrylic lacquer in which an aromatic vinyl monomer such as styrene or vinyl toluene is used in the form of a hard monomer as a resin composition demonstrates an extremely high gloss and extremely high properties, thereby being used more frequently in particular.

However, since these types of paint using acrylic lacquer are an air drying type, they demonstrate lower performance than that of cross-linking paint, particularly such as lower water resistance, lower weatherability and lower chemical agent resistance. As a result, these types of performance needed to be improved.

As a result of an eager research in elimination of the disadvantages, the inventors have discovered that the disadvantages can be eliminated at once by putting paramethyl styrene as a component of a polymer, thereby attaining the invention.

More specifically, the invention is acrylic lacquer, characterized by containing a copolymer at a 5000 to 50000 number average molecular weight, obtained by copolymerizing paramethyl styrene A at 5 to 95 weight % with other copolymerizable monomers B at 5 to 95 weight %, and if necessary containing one or two or more types of pigments, paint additives and fiber compounds, by a combination.

In this regard, the following compounds are used as monomers B copolymerizable to paramethyl styrene A: alkyl acrylate or alkyl methacrylate with 1 to 18 carbon atoms; β-hydroxyethyl(metha)acrylate; β-hydroxypropyl(metha)acrylate; acrylic acid; methacrylic acid; itaconic acid; fumaric acid; maleic anhydride; glycidyl(metha)acrylate; 2-ethoxymethyl(metha)acrylate; 2-ethoxymethyl(metha)acrylate; acrylonitrile; methaacrylonitrile; cyclohexyl(metha)acrylate. These compounds can be used alone or a mixture of two or more types.

In the invention, the amount of paramethyl styrene A used is in the range of 5 to 95 weight % in the obtained copolymer, preferably in the range of 10 to 80 weight %. On the other hand, the amount of copolymerizable monomers B used is in the range of 5 to 95 weight %, preferably in the range of 20 to 90 weight %.

At the invention, if the amount of paramethyl styrene used is sammer than 5 weight %, the water resistance and the chemical agent resistance (i.e., alcohol resistance) of acrylic lacquer are lower. In turn, if the amount of paramethyl styrene used exceeds 95 weight %, the weatherability is lower. t is preferred in terms of performance that the glass transition point of acrylic lacquer containing the said monomer composition is in the range of 40 and 95°C (a value calculated from the transition temperature of a single polymer of each monomer using a Fox's formula is considered as a glass transition temperature). The selection of each monomer to be copolymerized to paramethyl styrene should also be made from such a point of view. It is necessary that the number average molecular weight of the copolymer be 5,000 to 50,000, preferably 6,000 to 30,000. In this case, the number average molecular weight is indicated with a polystyrene reduction value using a gel permeation chromatography in accordance with a regular method. When the number average molecular weight is smaller than 5,000, it is not sufficient in terms of water resistance, chemical agent resistance and weatherability. In turn, when the number average molecular weight is larger than 50,000 at a high molecular weight, a threading effect occurs in terms of spraying work.

At the invention, a widely known polymerization is used to obtain a copolymer of paramethyl styrene with other copolymerizable monomers. Preferably, a solution polymerization is used. In addition to the said monomers, the following solvents are used:

aromatic hydrocarbons (e.g., toluene and xylene); esters (e.g., ethyl acetate and butyl acetate); ketones (e.g., methylethyl ketone and methylisobutyl ketone); alcohols (e.g., butanol and methanol). As for initiator, the polymerization is usually applied in the presence of widely known radical initiator such as azobisisobutyronitrile, benzoyl peroxide or t-butyl perbenzoate.

In addition, the acrylic lacquer obtained as described above can be used as a clear coating as it is while being diluted with proper paint thinner. Furthermore, if necessary, the acrylic lacquer can be used in the form of a mixture by mixing one or two or more types selected from pigments, paint additives and cellulose compounds as needed. As for pigments, pigments customally used in the paint field, including inorganic pigments such as titanium oxide, colcothar and calcium carbonate, and organic pigments. As for paint additives, widely known paint additives are used at their regular amounts, including an antifoamer, a leveling agent, an ultraviolet absorbent, an antioxidant and a pigment dispersion aide. Moreover, as for cellulose compounds, soluble cotton and cellulose acetate butylate are exemplified.

As for a painting method for acrylic lacquer of the invention, a widely known painting method is used, such as a brush painting, a spray painting or a roll painting.

In particular, the said acrylic lacquer of the invention demonstrates high water resistance, high weatherability, high chemical agent resistance and high coating performance by using a specific amount of paramethyl styrene.

The invention is described using the embodiments and the comparative examples next. Parts and % indicate weights unless particularly indicated.

Embodiments 1 to 3 and Comparative Examples 1 to 4

After toluene at 500 g and butanol at 500 g have been supplied into a four-neck flask equipped with an agitator, an inert gas supply inlet, a thermometer and a cooler, the temperature is made to increase. At the point where the temperature is increased to 98°C, a mixture indicated in Table 1 is dropped for 4 hours each. After this, polymerization is applied while the mixture is kept at the same temperature for 7 hours to obtain a desired copolymer. The number average molecular weights of the polymers are collectively indicated in Table 1. An aluminum paste (the product name: 1109MA; the product of Toyo Aluminum Corporation) at 10 parts is added each copolymer at 100 parts. After dispersing the mixture, lacquer is controlled so as to be 30 seconds using a Ford Cup No.4 applying thinner having a polymerization ratio of ethyl acetate/n-butanol/butyl cellosolve at 40/40/20. After this, a coating is applied to an iron plate of 0.6 mm with a Bonderite #144 treatment applied by a spraying means so that the film thickness becomes 15 to 18 μ. A baking is then applied at 60°C for 30 minutes.

After the baking, the iron plate is set aside at normal temperature for three days. The performance of obtained each coating film is evaluated. The performance evaluating results are indicated in Table 2.

Table 1

\ Examples	Embodiments			Comparative Examples			
	1	2	3	1	2	3	4
Paramethyl styrene, Styrene Methylmethaacrylate n-butylacrylate n-butylmethaacrylate Methacrylic acid Isobutylmethacrylate	[Please refer to the original numerical values]						
Polymerization initiator B.P.O							

Number average molecular weights							

Table 2

	Embodiments			Comparative Examples			
	1	2	3	1	2	3	4
Gloss 60° gloss using a glossimeter	[Please refer to the original numerical values]						
Ericksen extrusion (mm)							
Water resistance 80°C warm water emersion After 24 hours	No change	No change	No change	Whitened	Whitened blister	No change	Whitened blister
Chemical agent resistance (Xylole resistance) Rubbing after immersing xylole in gauze (Number of rubbings)							
Weatherability Gloss value after 100 hours with a weatherometer; 60° gloss							
Weatherometer: vision after 100 hours	Gloss lost	Gloss lost	Gloss lost	Choking Cracks generated	Choking Cracks generated	Choking	Choking Cracks generated

[Note]

Gloss: in accordance with a 60° mirror surface glossiness testing method using a JISK-5400.

Ericksen extrusion test: indicated with a maximum extrusion mm number at a level at which cracks do not occur to the coating film.

Water resistance: determined by eyes in comparison with the original plate by removing the plate immediately after immersing it in warm water at 80°C.

Weatherability test: in accordance with a weatherability testing method using JIS-K-5400.

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Chisato Morohashi